least one thing is certain—the writing-fluid used by the ancient scribes for such records as the foregoing must have possessed in a high degree the property of durability.

In one form or another, the basis of these early writing-fluids was carbon. For example, Chinese ink, the so-called "Indian" ink of the modern artist, which according to the native historians has been made since 2600 B.C. or thereabouts, was at first a vegetable varnish, and later a mixture of lampblack and glue. Inks containing gallate of iron did not come into use until a much later period. Thus Sir Humphry Davy, examining some documents recovered from the ruins of Herculaneum, "looked in vain amongst the MSS. . . . for vestiges of letters in oxide of iron," and he concludes that the Romans up to the time of Pliny had never used "ink of galls and iron" for writing purposes. Gradually, however, in the early centuries of the Christian era, there came a transition from carbon inks to those containing iron; and Blagden, in "Some Observations on Ancient Inks," communicated to the Royal Society in 1787, records that the writing fluid employed in various MSS. on vellum, dating from the ninth to the fifteenth centuries, was an iron and gall ink. Somewhat earlier than the date of Blagden's paper logwood began to find employment as a constituent of inks, and soon after the middle of last century came the next notable modification, namely, the use of aniline dyes in the manufacture of both black and coloured writing-fluids.

Of these and other matters bearing upon the history, composition, and methods of preparing the various kinds of inks, Messrs. Mitchell and Hepworth have much to tell us in the volume under notice. They have brought together, and made convenient for reference, material that has been hitherto chiefly scattered amongst periodicals and isolated dictionary articles. In so doing they have saved their contemporaries some labour, and earned for themselves much gratitude.

The book is divided into three sections. The first of these deals with writing inks, including those of which carbon, tannin, logwood, and aniline respectively form the characteristic ingredients. It comprises chapters upon the sources of the tannin materials, the chemical nature of iron-gall inks, and the best methods of examining both the fluid itself and the characters on the written page. Printing inks form the subject of section ii., in which an interesting chapter treats of colour work, including three-colour printing and inks for use in the production of cheques and bank-notes. In the concluding section there is a description of inks intended for miscellaneous purposes; these comprise copying, marking, safety, and sympathetic inks, and fluids for writing on glass, wood, ivory, or leather. Many formulæ are given, some of which the authors have personally tested, and the work closes with a list of English patents relating to the subject.

Despite occasional incoherency of style, the two collaborators have produced a useful and attractive little volume. One or two slips may be pointed out; thus the equation on p. 101 is incomplete, and the specific gravity of dilute hydrochloric acid is given wrongly on p. 208. In the historical introduction we are told, *apropos* of a certain document (p. 11), that "it was probably written at the end of the sixteenth century by a man past middle age, who learned to write just about the time that Shakespeare was born (1504)." At first it seems an unnecessarily cautious understatement to call such a man "past middle age," but a little reflection shows that it is those kittle cattle the figures that are to blame.

The book is a serviceable addition to the literature of chemical technology. C. SIMMONDS.

## OUR BOOK SHELF.

*Naturbegriffe und Natururteile.* By Hans Driesch. Pp. viii+239. (Leipzig: Wilhelm Engelmann; London: Williams and Norgate, 1904.) Price 4*s.* net.

THIS book deals chiefly with three topics. Starting on a Kantian basis, it seeks to state the *a priori* principles of pure physical science. (*A priori* is conveniently defined as "independent of the amount of experience.") Next, the leading principles of "energetics" are discussed, and their relation on the one hand to the *a priori* principles of pure physical science, and on the other hand to the ordinary laws of thermodynamics. Incidentally, the "laws" of conservation (of substance and the like) are examined, and entropy has a good deal of attention. Last of all the results attained are carried over to a discussion of biology. The point of view is neo-vitalistic. It would be hazardous to say that the author has run to earth the *x* which is the object of all our search, the vital principle or whatever other name may be applied to it; the term which he uses is the blessed word *entelechy.*

Herr Driesch is well known to be at his best a clear, original and suggestive writer. Much of the present work is excellent, but we doubt if the last eighty pages are either clear or convincing. Perhaps one would require to read the author's other works in order to accustom oneself to his point of view and his independent modes of statement. He is occasionally unsatisfactory as well when dealing with the theories of others, for example, with Prof. Clerk Maxwell's "sorting demon." The discussion occurs under the heading "Declarations of Physicists regarding Biological Subjects," and Herr Driesch almost seems at times to suppose or to imply that the conception may have been formed in order to limit the second law of thermodynamics to inanimate bodies. True, Lord Kelvin's statement of the second law has the words "in inanimate material." But Lord Kelvin's declaration is explicit ("Popular Lectures and Addresses," 1889, vol. i. p. 141):—"The conception of the 'sorting demon' is merely mechanical and is of great value in purely physical science. It was not invented to help us to deal with questions regarding the influence of life and of mind on the motions of matter." On p. 103 the accurate reference to Helmholtz's work is—Ostwald's *Klassiker* Nr. 124, p. 30, Anm.

*Higher Text-book of Magnetism and Electricity.* By R. Wallace Stewart, D.Sc. Being vol. iv. of "The Tutorial Physics." Pp. viii+672. (London: W. B. Clive, University Tutorial Press.) Price 6*s.* 6*d.*

WE have several times noticed this work as successive editions have appeared, and can speak as appreciatively of it as we have on other occasions. The present volume is based on the older one, but it has been wholly

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re-cast, and a very considerable quantity of new matter has been added in view of the rapid advance which has been made in electrical theory in the last few years.

In this edition the author has followed several other text-books in laying stress upon the importance of the electric field as the real seat of the energy of an electric circuit. It should be clearly brought out, however, that part of the energy must flow in the conductor, following there, as elsewhere, the direction of the equipotential surfaces; the forward flow is, however, in the dielectric itself. The figures exhibiting this flow of energy on pp. 344, 525, and 528 are very far from satisfactory. It is sufficient to point out that in every ordinary case of steady transfer the lines of force are convex *forwards;* indeed, if it be borne in mind that in accordance with Poynting's theorem the flow of energy takes place at right angles to the lines of force, there would be energy flowing out from and not into a conductor if the lines were as shown.

Too much care cannot be exercised in the construction of diagrams. They catch the eye; and just as nothing is better than a good diagram for inculcating truth, nothing can be worse educationally than one that is slipshod.

This remark applies equally to a figure illustrating the action of the keeper of a magnet on p. 227, where about twice as many lines of "force" are shown in the keeper as are represented in the magnet itself. Is the keeper supposed to be independently magnetised?

Again, on p. 401, if the equipotential lines on the plate exhibiting the Hall effect were really as shown, some of the current would flow over the edges of the conductor.

This slovenliness is almost wholly confined to the figures. The text is exceedingly lucid and painstaking in the endeavour to give a student a sound knowledge of physics. The large number of worked out examples, which have always been a distinguishing feature of the book, have no doubt contributed largely to the appreciation which it has received, especially from those who are compelled by circumstances to work without a teacher.

*Life and Energy—Four Addresses.* By Walter Hibbert. Pp. xiv+182. (London: Longmans, Green and Co., 1904.) Price 2*s.* 6*d.* net.

THE thesis of these four addresses—originally delivered at the Polytechnic Institute, London—is that life is not matter, is not energy, but an unceasing non-factorial directive control of energy and its transformations. "Directive control," *i.e.* in the same sense in which "temperature" in the case of heat, or "potential" in the case of electricity, controls the direction in which the energy shall flow. "Non-factorial," because while temperature, potential, and the like are factors of energy, life is not a factor.

Mr. Hibbert puts most of his points clearly, and much of what he says has considerable force. But it is doubtful if the range of ideas within which the book moves is adequate to the problem. The main position is not unassailable, and the deductions from it in regard to morals and religion are occasionally fanciful.

To descend to details. (1) It is difficult to see how the terms factorial and non-factorial describe precisely the difference between the directive control of energy manifested in inorganic and in organic bodies respectively. The discussion on p. 50 rather begs the question. (2) In describing God's directive control as being purely non-factorial, in saying (p. 144), "It is not the office of prayer to seek any direct disturbance of the course of material nature," but "its office is to secure a renewed faith in non-factorial control," Mr. Hibbert lays himself open to the retort, "Then non-factorial control is no control at all." (3) "Provided that life is a physical entity, it must be either matter or energy" (p. 16). "If it is a form of matter, it must weigh something" (p. 17). But what if it were ether? (4) "The living plant opens out a new path in which physical law can operate" (p. 39)—"it has, in a sense, directed the energy into special channels" (p. 38). But is this a differentia of life? Surely to one acquainted only with other manifestations of energy the path opened out by the dynamo is as new as anything can be.

*Glossary of Geographical and Topographical Terms.* By Alexander Knox, B.A., F.R.G.S. Pp. xl+432. (London: Edward Stanford, 1904.) Price 15*s.*

THIS work, which is intended as a supplementary volume to Stanford's "Compendium of Geography and Travel," is evidently the outcome of a vast amount of industrious research on the part of the author. The amount of labour involved in the collection of some 10,000 geographical terms derived from the most diverse languages all over the world can readily be imagined, and it can only excite our admiration that so much should have been successfully accomplished by a single individual. The book will be a decided boon to readers of works of geography and travel, who, in the absence of deep linguistic attainments, must constantly be puzzled by the terms employed in the place-names of foreign countries. It will also be valuable to the more scientific geographer as supplying a useful basis for the complete dictionary of geographical terms, which has long been felt to be a desideratum. Mr. Knox's book, useful as it is, can hardly be said to supply this need, being concerned rather with the general and popular, than with the scientific and technical usage of geographical terms. It was undertaken in the first instance, as the author explains, with a view to elucidate the terms in use in extra-European countries, and this object it certainly fulfils with success. European geographical terms, which naturally include the majority of those with which the scientific geographer is concerned, are less fully dealt with, and we not only miss many such technical terms as "Karst," "Kar," "Horst," "Schrund," "Aven" (to take a few only at random), but we find little attempt made at discrimination between the terms in use for closely allied features, or at the definition of nice shades of meaning, such, *e.g.*, as are involved in the words "dale" and "dell," both of which are explained merely as a "valley." Many English local terms are missing, and the definition of others is not always quite satisfactory. On the other hand various Spanish topographical terms are carefully explained, and the recent definitions by the International Commission for the Study of the Sea of the main features of suboceanic relief are correctly given.

But the special value lies in the fact that the information supplied is just that which is most out of reach of the ordinary reader, terms derived from the languages of Africa, Asia, and the less known parts of the world generally, being particularly well represented. The introduction includes some useful hints, by Dr. A. H. Keane, on the laws of interchange of letters in various languages.

*Blackie's Handy Book of Logarithms.* Pp. 128. (London: Blackie and Son, 1904.) Price 2*s.*

*Vier- und fünfstellige Logarithmentafeln.* Pp. 24. (Brunswick: F. Vieweg and Son, 1904.) Price 0.80 mark.

IN order that mathematical tables intended for common use may serve their purpose, it is essential that great attention be paid to the labour-saving arrangements which authors have from time to time introduced, such as the careful grouping of the figures in rows and columns, the use of varied type or of differently

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